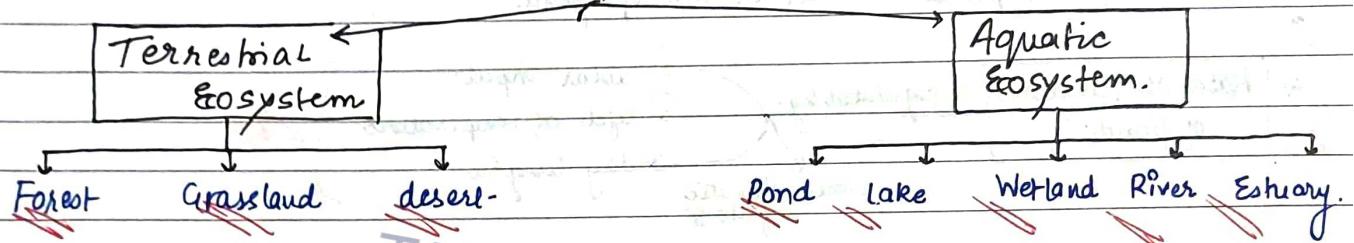


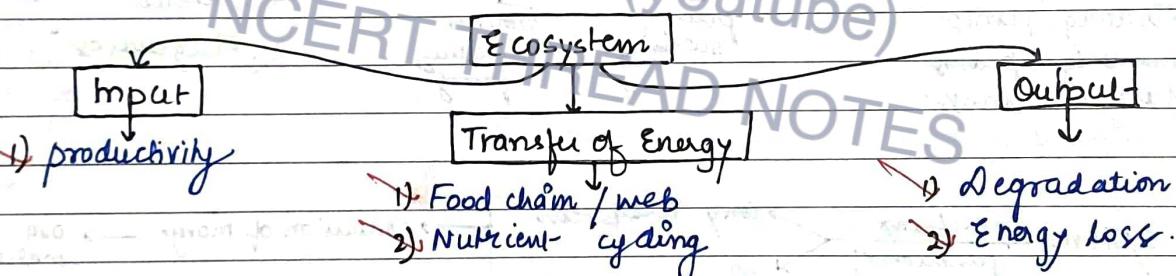
Ecosystem

* Functional unit of Nature - Ecosystem organum interact among themselves with the surrounding physical environment.

Vary in size
From, Small pond. to Large forest or sea.
Many ecologists regard (entire biosphere) too (big complex) to be studied at one time, so



Man-made Ecosystem
Crop fields
Aquarium



Ecosystem - STRUCTURE & FUNCTION

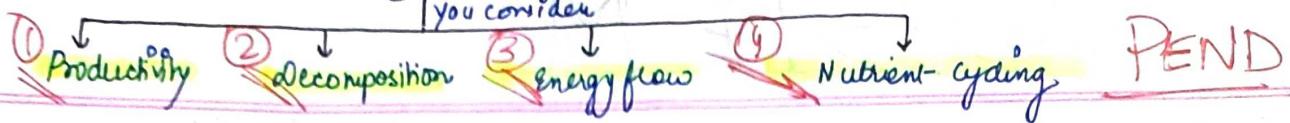
* Components → abiotic & biotic interaction of these. result in physical structure, that is characteristic for each type of ecosystem.

* Species Composition is given by [① identification of plant species] & [② Enumeration of animal species]

* Stratification is → Vertical distribution of different species occupying different levels

- Example
- Layer of forests
 - trees — Top layer
 - Shrubs — 2nd Layer
 - herbs & grasses — Bottom layer

* Components of Ecosystem are seen to function as a unit when you consider



* POND → self sustainable unit

explains even the complex interactions that exist in aquatic ecosystems term.

• Shallow water body } in which all above 4 components well exhibited.

Abiotic factors

① Water → with dissolved morganic subst.
② rich soil deposits → at bottom of pond. organic subst.

* Rate of Function of pond

regulated by
① solar input
② cycle of temperature
③ day length
④ other climatic factors

* Autotrophic components

- 1) phytoplankton
- 2) Some algae
- 3) Floating plants
- 4) Submerged plants
- 5) Marginal plants
↳ found at edges

Consumers

1) Zooplankton
↳ free swimming
2) Bottom dwelling forms

Decomposers

1) Fungi
2) Bacteria
3) Flagellates
↳ especially abundant on bottom of pond?

* This system performs function of

any ecosystem
Biosphere as a whole

Conversion of morg. → org. material
with help of

Radiant energy of sun by autotrophy

consumption of autotrophy by heterotrophy

① decomposition
② mineralization
↳ to release nutrients back for use of autotrophy
of dead matter

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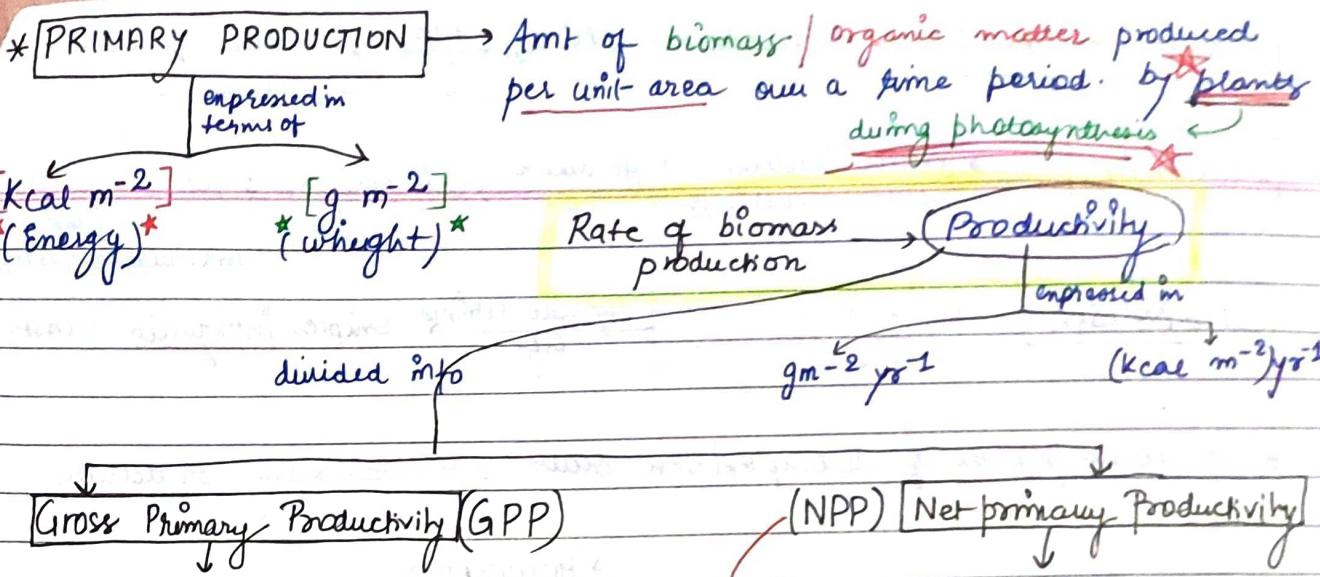
NCERT THREAD NOTES

PRODUCTIVITY

There is UNIDIRECTIONAL MOVEMENT OF ENERGY towards higher trophic levels

1) Its dissipation & loss as heat to environment
2) loss as heat to environment

* Basic requirement — constant input of Solar energy



Rate of production of organic matter during photosynthesis

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NCERT THREAD NOTES

A considerable amt of GPP is utilised by plants in respiration
 $\text{[GPP} - \text{R} = \text{NPP}]$

available biomass for consumption to heterotrophs
 herbivore decomposer

* **SECONDARY PRODUCTIVITY** → Rate of formation of new organic matter by CONSUMERS.

* **Primary Productivity** depends on ① plant species inhabiting a particular area.
 also on ② variety of environmental factors
 ③ availability of nutrients ② photosynthetic capacity of plants
 varies in different types of ecosystem

~~imp~~
 Annual NET Primary productivity → 170 billion tons (dry weight of organic matter)
 (of WHOLE BIOSPHERE)

Productivity of Oceans
 (despite occupying 70% of surface) 55 billion tons

Land 115 billion tons

DECOMPOSITION → Earthworm - Farmer's friend

Decomposers break down complex organic matter

① help in breakdown of complex organic matter
 ② loosening of soil

into
 inorganic substance like water nutrients

Detritus → raw material for decomposition

dead remains of plants & animals (leaves, bark, flowers, fecal matter)

Fragmentation → Breakdown detritus $\xrightarrow[\text{detritivores}]{\text{into}}$ smaller particle

[detritivores] → earthworm.

Leaching → Water Soluble inorganic nutrients go down into soil horizon & get precipitated ↓ as unavailable salts

Catabolism → Bacterial enzymes $\xrightarrow{\text{Fungal enzymes}}$ degrade detritus into simpler inorganic subst.

* All above process of decomposition occur simultaneously on detritus

① During decomposition in Soil → occurs

HUMIFICATION

MINERALISATION

Humification

Leads to accumulation of

- * dark coloured
- * Amorphous subst \rightarrow HUMUS $\xrightarrow{\text{colloidal}} \text{Reservoir of nutrients}$
- (1) highly resistant to microbial action
- (2) Decompose at an extremely slow rate

Mineralisation

Humus degraded by microbes releasing inorganic nutrients

* {DECOMPOSITION} → largely an oxygen requiring process.

Rate of decompo-

sition controlled by chemical composition of detritus

• environment/ climatic factors

soil microbes

effect of

Temperature
Soil moisture

in a particular climatic condition

slower if
detritus rich in
lignin chitin

Decomposition Rate

quicker if

detritus rich in
water-solu-
ble
substance
like
sugars

* ① Warm

② moist environment
 \downarrow favours
decomposition

* ① low temp.

② anaerobiosis
 \downarrow inhibits
decomposition

(*) results in building up of organic material

ENERGY FLOW

{ Sun } → only source of energy for ALL ecosystems [Except: Deep sea hydrothermal vents]

of incident solar radiation

< 50%

PAR
(photosynthetically active radiation)

Plants capture 2-10% of PAR

We know

Plants

Photosynthetic Bacteria
(autotrophs)

simple
inorganic
material

from Food

fix's sun's
energy to
matter

this small
amt of
energy
sustains entire living world.

* All organisms dependent on
for food Producers either

directly
indirectly

Unidirectional flow
of ↓ energy
from sun
to producers

consumers. ← then to

* Ecosystem ~~not
except from~~ 2nd Law of thermodynamics

need constant supply of energy to synthesise molecules they require

↑↑ disorderness towards Universal tendency to counteract-

* Producers - green plants in ecosystem

Terrestrial Ecosystem

- Herbaceous plants
- Woody plants

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Aquatic Ecosystem

- phytoplankton
- Algae
- Higher plants

* Chain / Web of food formed due to interdependency

* No energy trapped into a org remains in it forever

Energy trapped
(by producer)

passed on to consumer

or → organism dies

* death of org.
starting of

Detritus
Food chain / web.

* All animals - Consumers / Heterotrophy.

Primary Consumers
(feed on producers)

Ex. Insects → HERBIVORE

Birds
Mammals in Terrestrial Eco.
Molluscs in Aquatic Eco.

Secondary Consumers

(Eat an animal which
in turn eat plants)

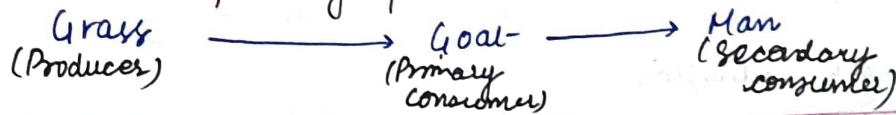
Primary Carnivores (eat herbivores)

Tertiary Consumers

Secondary Carnivores

(Animals which depend on
primary carnivore for food)

Simple Grazing Food Chain (GFC)



Detritus Food Chain (DFC) begins with ^① dead organic matter

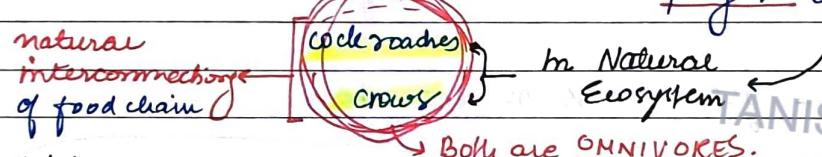
made up of **Decomposers** (Heterotrophic organisms) also known as **SAPROTROPHS** → to decompose mainly **Fungi** **Bacteria** they meet their energy requirement by degrading dead organic matter

* Decomposers secrete digestive enzymes → break down into simple, inorganic material absorbed by them.

* In Aquatic ecosystem major conduit for energy flow → **GFC**

* In Terrestrial " " " → **DFC** rather than GFC.

* DFC can be connected to GFC (at some level) → **some org. of DFC are a prey to GFC animals.**



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NCERT THREAD NOTES

* Organisms occupy a place in natural surrounding / community → acc'n to their Feeding Relationship with other organisms.

* Organisms occupy a specific place in food chain (TROPHIC LEVEL) → based on source of nutrition / food.

* Amt. of energy ↓ decreases at successive trophic levels.

* When organisms die it is converted to **Detritus / Dead biomass** → serves as ENERGY SOURCE for decomposer.

* Organisms at each trophic level depend on those at lower trophic level → for energy demands

Standing Crop → Each trophic level has certain mass of "Living material" at a particular time measured → ① Biomass (mass of living organism) OR ② Number in a unit-area.

* Biomass of a species expressed in → fresh weight →
Dry weight → more accurate

* No. of Trophic levels restricted as → Transfer of energy follows 10% law (in GFC)

Each Trophic level transferred only 10% of energy from lower one

* In NATURE → it's possible to have so many levels → producer → herbivore → primary carnivore → secondary carnivore

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NCERT THREAD NOTES

ECOLOGICAL PYRAMIDS

Plz see Diagrams in NCERT

* Gets similar shape whether you express it in → food → Energy relationship b/w organisms at different trophic levels

* Relationship expressed in terms of → Number Biomass Energy

* Base of each pyramid — producers / 1st trophic level.

* Open represents — Tertiary / Top level consumer.

* Given organism — may occupy more than one trophic level simultaneously

* Trophic level → Functional level
does not represent species

* Species may occupy more than one trophic level in some ecosystem at same time.

Eg. → Sparrow → primary consumer - eats seeds → fruit-pears
→ secondary consumer - eats insects → worms.

* In most ecosystems → All pyramids of Number Energy Biomass upright

* Energy at lower trophic level > Higher level.

• producer > Herbivore
(in both number & biomass)
• Herbivore > Carnivore

 Inverted pyramids

- of Biomass - In sea bcz Biomass of fish >> phytoplankton
- of Number - Tree ecosystem

* Pyramid of Energy - Always upright // bcz at next-trophic level some energy always lost as heat.

Each bar in pyramids amt of energy present - at each trophic level in a given time or annually per unit-area.

{ Certain Limitations in Ecological Pyramids }

does not take into account - the same species belonging to 2 or more trophic levels

Assumes a simple food chain (something that never existed in nature) does not accommodate a food web.

not Saprophytes are given any place in ecological pyramids even though they play vital role in ecosystem

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ECOLOGICAL SUCCESSION

Important characteristic of Community

① their structure & composition changes constantly

in response to changing environmental conditions

* This change is ① orderly & ② sequential

③ parallel with the changes in physical environment

These changes lead finally to Community - that is near equilibrium with environment

CLIMAX COMMUNITY

* Gradual & predictable change in the species composition of a given area

ECOLOGICAL SUCCESSION

is called

* During succession → some species colonise an area & their population increases whereas others decline & eventually disappear

* Entire sequence of communities that successively change in a given area.

SERE (s)

* Individual transitional communities termed as SERAL STAGES | SERAL COMMUNITIES

* In successive serial stages there is a change in diversity of species of organism
 * increase in no. of species & organisms
 * increase in Total biomass

* Present day communities (in world) is succession that occurred over millions of years bcz of life started on earth since

~~* Succession~~ parallel process at that time
~~* Evolution~~

* Succession → starts in an area where no living organisms are there,

Primary succession

Secondary succession

* NO living org. ever existed

Eg → Bare rock

② Newly cooled lava

③ Newly created pond / Reservoir

* Area that somehow lost all the org. that existed there.

Eg - Abandoned farm lands

Burned forests

Cut forest

Lands have been flooded.

* Establishment of new biotic community is GENERALLY SLOW.

before this is established there should be soil

* Depending mostly on climate

↓ it takes natural process

100 - 1000's yrs to produce FERTILE SOIL on Bare Rock.

* In areas, where natural biotic communities have been destroyed.

* Since some soil / sediment present-
 ↓
 faster than primary succession

* Description of ecological succession usually focuses on changes in vegetation.

Various types of animals.

for food
shelter

these vegetational changes in turn affect

succession proceeds → number of animals also change
types decomposers

* At any time during primary / secondary succession

Natural disturbance

Human induced

disturbance (fire, degeneration)

* Such disturbances create new conditions that encourage some species discourage / eliminate other species

Early stage

Particular

Serial stage of succession can convert

Succession Of Plants

Based on Nature of Habitat

In wet areas →

(hydric → mesic)

Hydarch ~~Succession~~ Succession

In dry areas →

Xerarch succession

(xeric → mesic)

Mesic - medium water condition

• neither too dry, nor too wet

* Species invading bare area - Pioneer species

* Primary succession on rocks - Lichens → secrete acid to dissolve rocks.

take hold in small amount of soil.

able to
these pave
way to

BRYOPHYTES
(very small plants)

help in weathering & soil formation

succeded
by

Higher plants

after several more stages

Stable
Climax
Forest
Community
is formed

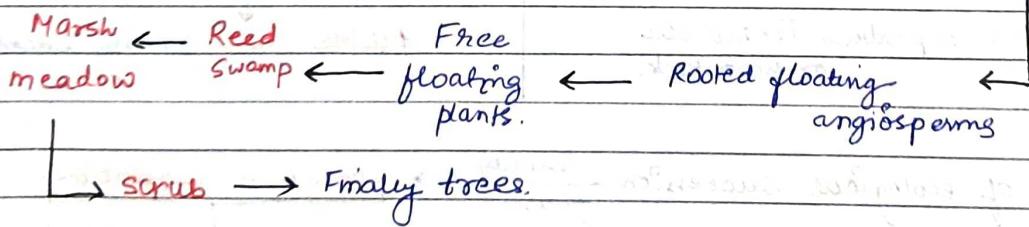
* Climax community remains stable as long as environment remains unchanged.

* With time, Xerophytic habitat gets converted into Mesophytic one.

PRIMARY SUCCESSION IN WATER → Pioneers - small phytoplankton

replaced by

Rooted submerged plants.



* Climax - Forest



* With time water body converted into land.

SECONDARY SUCCESSION → species that invade depends on

Soil is here → rate of succession
much faster

hence climax reached
more quickly.

- condition of the soil
- availability of water
- environment
- seeds/propagules present

* Primary succession → very slow process.
 → takes thousands of years for climax to be reached.

* All succession whether taking place on \rightarrow land
 \rightarrow Water → proceeds to similar climax community
 \downarrow
 living org. rocks, air, water → NESIC.

(BIOGEOCHEMICAL CYCLES)

NUTRIENT CYCLING → storage movement of nutrient elements through various components of ecosystem.

Organisms need constant supply of nutrients to → grow
 → reproduce
 → regulate various body function

STANDING STATE - The amount of nutrients (C, N, P, Ca etc...) present in soil at a given time.

varies in
 different kinds of ecosystem
 on seasonal basis

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NCERT THREAD NOTES

* Nutrients never lost from ecosystem → recycled time & again indefinitely.

Gaseous cycle

Nitrogen, Carbon

Reservoir - atmosphere

Sedimentary cycle

Sulphur, Phosphorus

Reservoir - sedimentary Earth
Coast

Function of Reservoir - to meet with deficit which occurs due to
 Teacher's Signature.....
 imbalance in rate of influx
 & efflux.

Environmental factors

regulate the rate of release of nutrients into the atmosphere.

ECOSYSTEM - (Carbon Cycle)

'C' constitutes 49% of dry weight- of organisms
next to water

Total Global Carbon

71% 'C' - dissolved in OCEANS
1% 'C' - in atmosphere.

Reservoir that regulates amount of C in atmosphere

Fossil fuels - also Reservoir of Carbon.

- ★ 4×10^{13} kg carbon is fixed annually in biosphere through photosynthesis
- ★ Considerable amount of carbon returns to atmosphere as CO_2 through - respiratory activities of producers & consumers.
- ★ Decomposers - contribute substantially to CO_2 pool by processing of - waste materials & dead organic matter of land or oceans.

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Additional sources for releasing CO_2 in the atmosphere

-
- Burning of wood
Forest fires
 - Combustion of organic matter
Fossils fuels
 - Volcanic activity

Human Activities have significantly influenced Carbon cycle.

- Rapid Deforestation
- Massive burning of fossil fuel (for energy Transport)

↑↑ rate of release of CO_2 into atmosphere.

ECOSYSTEM - Phosphorus Cycle

Many animals need it
(large quantities) of 'P' to
make shells
Bones
Teeth.

major constituents of Biological membranes
Nucleic acid
Cellular energy Transfer system

* Natural Reservoir of P - Rock (contains 'P' as phosphates)

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When weathered minute quantity
of phosphate dissolves in soil
solution

& absorbed by the roots

NCERT THREAD NOTES

* Herbivore & other animals get 'P' from Plants

* Waste products
Dead organisms

decomposed by phosphate-solubilising bacteria
releasing PHOSPHORUS.

* Unlike 'C' cycle, no respiratory release of 'P' in atmosphere.

(*) 2 Differences b/w Carbon & Phosphorus Cycle:

1) Atmospheric inputs of phosphorus through rainfall is << than carbon inputs.

2) Gaseous exchanges of phosphorus b/w organisms & environment are negligible.

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ECOSYSTEM SERVICES

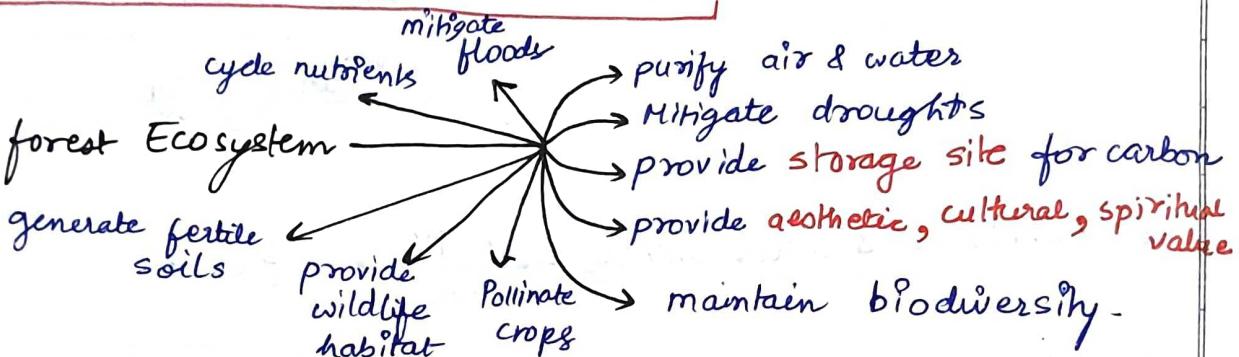
Healthy ecosystem ————— base for

wide range of economic
environmental
Aesthetic

goods &
services

Products of ecosystem process] named or Ecosystem Services

① Healthy forest Ecosystem



Value of such services difficult
to determine

→ Biodiversity should carry
a hefty price tag

* ROBERT CONSTANZA & his colleagues → very recently tried to
put price tags ~~off~~ on
Nature's life supporting services

* Researchers have put Avg. price tag of US \$ 33 trillion / a year
on fundamental ecosystem services.

nearly twice ✓
the value of the global
GDP (gross national product)
→ US \$ 18 trillion.

but are taken for granted bcz
they have free.

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NCERT THREAD NOTES

* Out of the total cost of various ecosystem services :

1) Soil formation accounts for 50 %.

2) Recreation
Nutrient Cycling] → are less than 10% each ~~each~~

3) Climate Regulation
Habitat for Wildlife] → about 6% each ~~each~~

New

→ Few Points from SUMMARY :

1) Atmosphere Or Hydrosphere is reservoir for gaseous type of cycle (carbon)

* 2) Biotic community — Dynamic

Undergoes (changes) with the passage of time

are sequentially ordered

↓ constitute

ecological succession

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